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Life Cycle of *Oecobius annulipes* LUCAS (Araneae: Oecobiidae) under Indoor Conditions and the Effect of Photoperiod on Nymphal Development

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宮下和喜[1)]：チリグモの室内での生活環と幼生（若虫）発育に及ぼす光周期の影響

Abstract Adult females of *Oecobius annulipes* LUCAS collected from April to early September lived for 1–4 months under indoor conditions and produced 1–6 egg-sacs, but those collected after mid September overwintered, and then began to produce egg-sacs in the following spring. Nymphs reared under natural and long (LD–16:8) photoperiods overwintered at the last instar or after attaining adulthood. Upon rearings under a short (LD–10:14) photoperiod, the instar at which they overwintered varied among individuals, but the time of emergence as adults in the followni spring was about the same as that of individuals reared under natural and long photoperiods. Since adults appear in succession from April to early September and lay egg-sacs, there occurs an excessive generation overlap in the year.

Introduction

The spider *Oecobius annulipes* LUCAS is a popular species in urban areas, and often inhabits buildings. In addition, individuals at different developmental stages including adult are easily found throughout the year. Why are they able to settle in buildings readily and to appear at different developmental stages in any season? In order to investigate these points, I conducted an experiment on the analysis of life cycle and the effect of photoperiod on nymphal development of this spider under indoor conditions. This is a brief result of that experiment.

Materials and Methods

In order to assess the seasonal changes in reproduction of *O. annulipes*, 1–3 adult females were collected from several sites of our former school building

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(2-1-1 Fukazawa, Setagaya-ku, Tokyo) at intervals of 15–30 days from April to November, 1988. The collected females were kept individually in lidded transparent plastic containers, 11 cm wide, 10 cm deep and 2.5 cm high, and reared until their death for examination of egg-sac production and the number of nymphs that emerged from each egg-sac. A small number of adult males was also collected and reared for comparison with females. The containers were placed on a desk by the window of a corridor, and protected from direct sunshine and artificial light. Each spider was provided 3–5 prey at intervals of 3–4 days. The prey were *Sinella cuspidatus* (Collembola) and *Drosophila melanogaster* (Drosophilidae) adults, provided alternately.

In another experiment, nymphs that emerged from egg-sacs on 9 June were reared under a natural photoperiod, whereas those emerging on 24 June were did so under long (LD–16.8) and short (LD–10:14) photoperiods. This difference between starting dates in both rearings was simply because experimental animals were not obtained enough on 9 June. Natural photoperiod means ordinary light conditions prevailing at the location where the spiders were kept. Day length was 15 h 48 min on 9 June (start of rearing), 10 h 56 min on 22 December (winter solstice) and 15 h 37 min on 31 May of the followning year (the date on which the last individual developed into an adult). The long and short photoperiods were created using wooden boxes, 60 cm wide, 45 cm deep and 45 cm high, equipped with a 4–W fluorescent tube connected to a time switch, the tube generating 250–300 lux. The boxes were also placed on the same desk in the corridor as described above. The rearing method was the same as for the adult females, but small-sized prey were provided only during the first half of the rearing period.

Temperature and humidity were not controlled. However, these were influenced by steam central heating for the building during the period between December and March.

Results and Discussion

Figure 1 shows the survival period and egg-sac production of the adult females collected in different seasons. In the graph, data on survival periods of several adult males have been added for reference.

Because of the uncertain age of adult females collected in different seasons, their total actual longevity and potential number of egg-sacs produced during life were impossible to estimate by means of this experiment. However, the females collected from April to early September lived for 1–4 months and produced 1–6 egg-sacs including sterile ones. The number of nymphs emerging per healthy egg-sac varied from 1 to 16, with a calculated mean of 7.6 ± 3.8 (SD). The majority of females collected after mid September overwintered, and thereafter began to produce egg-sacs in April of the following year, although all egg-sacs produced were sterile, probably due to their being collected before mating.

In adult males, the mode of life was thought to be about the same as that of adult females from the data shown at the bottom of Fig. 1.

Thus it appears that the adults of this species emerge in succession during the period from April to September and begin to produce egg-sacs immediately,

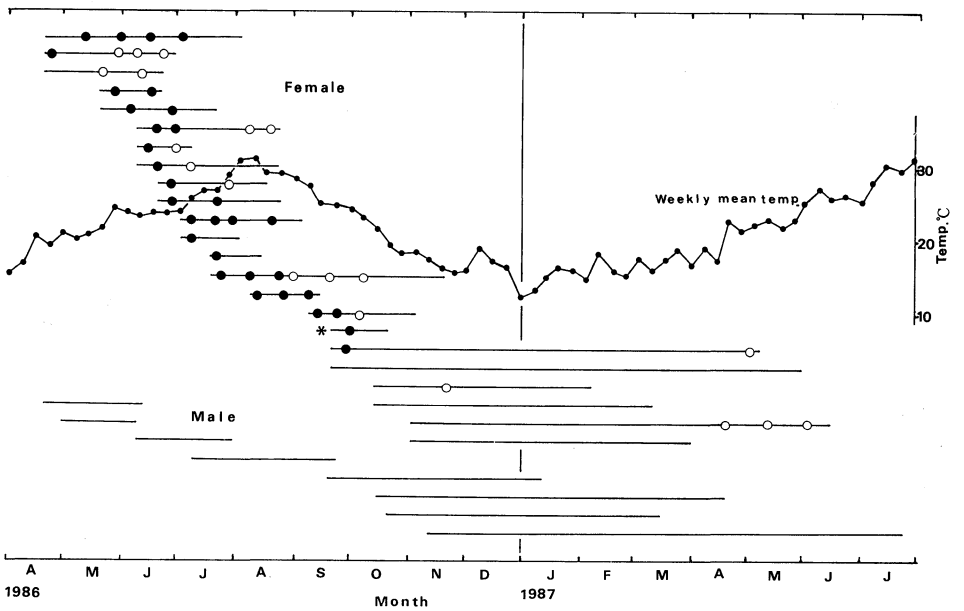

Fig. 1. Survival period and egg-sac production of *Oecobius annulipes* adult females collected in different seasons from April to November of 1988. Data on several adult males are added at the bottom. Horizontal lines indicate survival period, black and white circles are healthy and sterile egg-sacs, respectively. Fine line shows weekly mean temperature.

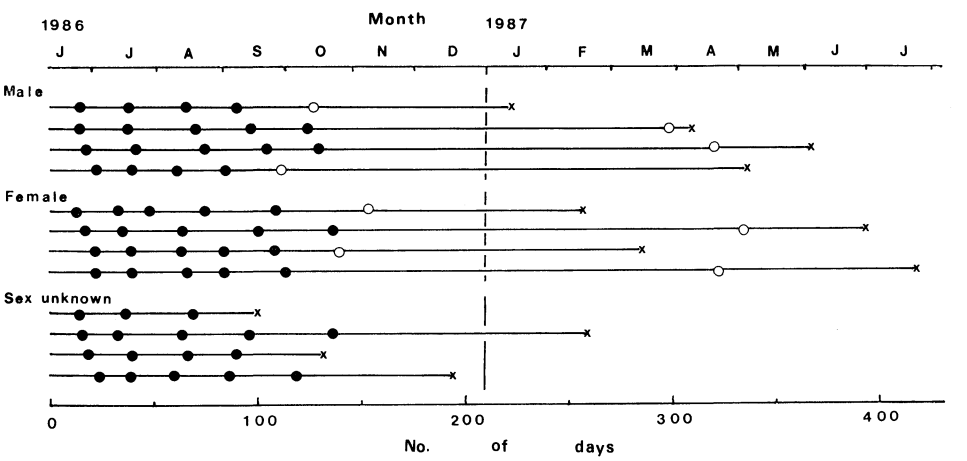

Fig. 2. Developmental process of *Oecobius annulipes* nymphs reared under a natural photoperiod. Black circles indicate moltings, white ones last molting, × death.

but interrupt their reproduction when the weekly mean temperature falls lower than 20°C in late September or after this for overwintering. Overwintered adults resume reproduction when the weekly mean temperature becomes higher than 20°C in the spring of the following year. This is one reason why the nymphs at different instars and adults of this species can easily be found throughout the year.

Figure 2 shows the developmental processes of nymphs reared under a natural photoperiod. Although the developmental processes of nymphs differed greatly among individuals, they formed 2 groups according to the instar at which they began to overwinter, i. e., in one group, the individuals developed into adults by autumn and then overwintered, and in the other they overwintered at the last instar and developed into adults in the spring of the following year. In the former group, the developmental period until adulthood was 110–130 days, and the number of molts was 5 in males and 6 in females. In the latter group, these figures were 295–335 days and 6 for both sexes, respectively.

Figure 3 shows the developmental processes of nymphs reared under long and short photoperiods. In those reared under a long photoperiod, the developmental process was substantially the same as that under a natural photoperiod, except for one male that developed into an adult in January of the following year. Among those reared under a short photoperiod, however, no individual developed to adulthood by autumn, although one male did so in January of the following year. The majority of individuals began to overwinter at different instars and thereafter developed into adults by the following May, but the time of their development to adulthood in the following spring was not greatly delayed as compared with that of individuals overwintering under natural and long

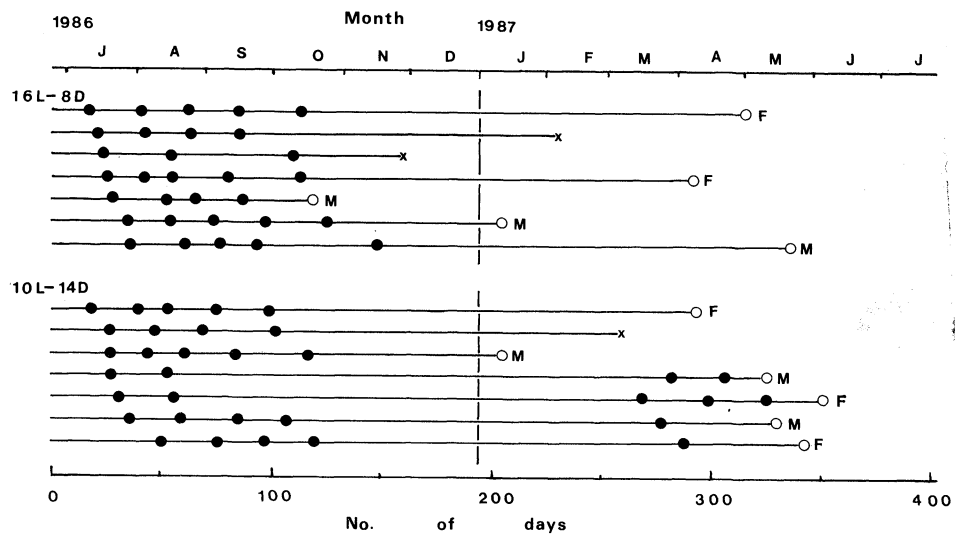

Fig. 3. Developmental process of *Oecobius annulipes* nymphs reared under long (LD–16:8) and short (LD–10:14) photoperiods. M indicates male, F female, and the other symbols are the same as in Fig. 2.

photoperiods. When we consider this result together with that shown in Fig. 1, it is thought that this spider is able to overwinter at any developmental stage in response to low temperature occurring in the forthcoming winter. This is another reason why the nymphs at different instars and adults of this spider can easily be found throughout the year. SCHAEFER (1987) called those species which possess above mentioned character as eurychronous species, and suggested that such species do not overwinter in the state of diapause. In the present experiment, I could not examine whether or not the overwintering individuals were in the state of diapause due to technical difficulties of rearing in a large number, thus further investigation on this point is needed to understand the real life history of this spider.

According to MIYASHITA (1987 and 1988), spiders which often inhabit buildings, such as *Achaearanea tepidariorum* (C. KOCH) and *Pholcus phalangioides* (FUESSLIN) develop normally under a short photoperiod, whereas species living only in the field, such as *Dolomedes sulfureus* L. KOCH and *Xysticus croceus* FOX undergo strong developmental retardation under a short photoperiod (MIYASHITA, 1986 and 1989). As shown in Fig. 3, the nymphal development of *O. annulipes* showed no conspicuous retardation under a short photoperiod, although several molts in later stage carried over to the following spring. It is considered that this flexible reaction to a short photoperiod enables them to settle easily in buildings, wherein they are obliged to live under the influence of extra light phase produced by artificial lighting.

Acknowledgement

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摘　　要

屋内でのチリグモの生活環を調べるため，定期的にメス成体を捕えて飼育し，産卵状況を調査したところ，このクモは4月から9月にかけていつでも産卵していることがわかった．したがって，この期間中はいつも幼生（若虫）が出現してくるので，生活環ははなはだしい世代の重なり合いを持ったものになっている．また，6月に得た幼生を自然日長および長日と短日条件下で飼育したところ，自然および長日条件下での発育はほとんど同じであったが，短日条件下では後期の脱皮が翌春に持ち越される傾向が認められた．しかし，いずれの場合でも秋または翌年の春までには成体にまで発育した．

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